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U. S. DEPARTMENT OF AGRICULTURE

U. S. Department of Agriculture

FARMERS' BULLETIN No. 1566

sl.
rev.
Apr 1941

THE SORGHUM MIDGE

*with suggestions
for control*



THE SORGHUM MIDGE costs American farmers millions of dollars every year in the damage which it inflicts on the grain sorghums, and great losses are also caused in the seed crops of other sorghums, broomcorns, and Sudan grass.

The larvae of this insect damage the crops by consuming the plant juices of the developing seeds. The egg is laid in the spikelet of the host plant, and the developing insect remains there through the succeeding stages to maturity.

Although the use of insecticides has not been found practical for controlling this pest, certain cultural measures are recommended in this bulletin for reducing the losses caused by it and lessening or avoiding infestation.

Washington, D. C.

Issued September 1928
Slightly revised April 1941

THE SORGHUM MIDGE, WITH SUGGESTIONS FOR CONTROL

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Contents

| | Page | | Page |
|--|------|--|------|
| Importance of the midge and nature of the injury caused by it..... | 1 | Natural enemies..... | 5 |
| Distribution of the midge and plants attacked..... | 1 | Important facts bearing on the control of the sorghum midge..... | 6 |
| Life of the midge..... | 2 | Recommendations for control..... | 7 |
| Seasonal history..... | 4 | | |

IMPORTANCE OF THE MIDGE AND NATURE OF THE INJURY CAUSED BY IT

THE SORGHUM MIDGE (*Contarinia sorghicola* (Coq.))¹ is by far the most important insect attacking the grain sorghums. Every year its ravages on these crops, which have an annual farm value of about \$100,000,000, amount to millions of dollars. Besides damaging the grain sorghums, this pest causes great losses in the seed crops of the sweet sorghums, Sudan grass, and broomcorns. In many sections where the sorghum midge is especially abundant a yearly loss of approximately one-fifth of the crop occurs, and in years particularly favorable to the midge these sections produce practically no grain whatever.

The injury caused by the sorghum midge consists in the blighting, or blasting, of infested grain. The larvae extract the plant juices from the developing seeds, causing them to shrivel and dry. The affected grain or seed becomes shrunken and sometimes discolored, so that the infested spikelets resemble sterile ones. In some cases the injuries popularly known as "blast" or "blight" may be due to other causes, but generally they are the result of infestation by the midge.

DISTRIBUTION OF THE MIDGE AND PLANTS ATTACKED

The sorghum midge was probably introduced from southern Asia some time during the last half of the nineteenth century and is now well established throughout the principal sorghum-producing sections of the United States (fig. 1). Although serious losses occur in the Central and Eastern States, the greatest injury from this pest is found within the more humid sections of its range in the Gulf States.

¹ Order Diptera, family Itonididae.

No variety of sorghum has yet been found to show any great resistance to the attacks of the sorghum midge. This insect readily infests all varieties of the grain sorghums, sorgos (sweet sorghums), broom-corn, Johnson grass, and Sudan grass. Purpletop (*Triodia flava* (L.) Smyth), a wild grass plentiful in many of the Southern and Eastern

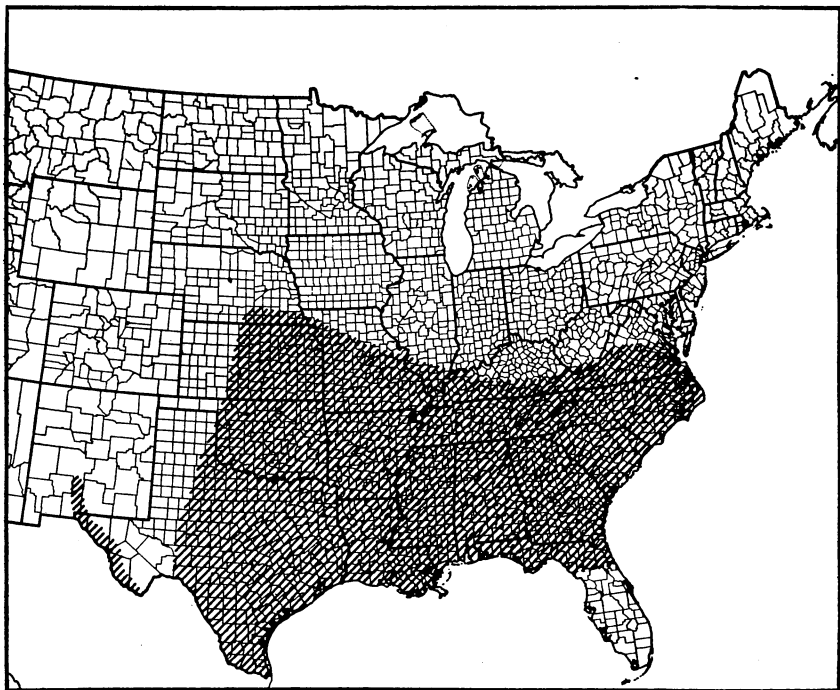


FIGURE 1.—The shaded portion of the map shows the known distribution of the sorghum midge in the United States.

States, is also sometimes infested. Apparently the midge does not breed extensively in any other native wild grasses.

LIFE OF THE MIDGE

If the heads of any of the previously mentioned host plants are examined while in bloom, many small, reddish, gnatlike flies, or midges, may be found crawling actively over the spikelets. The flies are the adult females (fig. 2) of the sorghum midge, which are busily laying their eggs within the spikelets. These eggs hatch, and adults develop from the larvae, or maggots, in about 2 weeks. At that time the male midges are swarming about these same heads waiting for the emerging females. Most of the emergence takes place during the early morning hours. Mating occurs soon after emergence, and the females fly to the nearest suitable heads to lay their eggs. The males live only a few hours during the warm summer months and seldom fly very far from the heads from which they have emerged. The females that have had opportunity to oviposit freely seldom live more than 1 day

during the summer, but they may live a little longer in cooler weather, when they are not so active.

Each female lays approximately 100 tiny white eggs (fig. 3), attaching them to the inner wall of the glumes, or what will become the seed husks. Although not more than 1 egg is deposited at a time in a

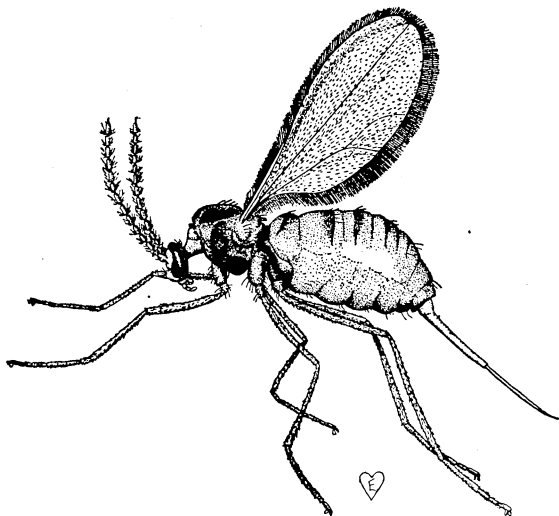


FIGURE 2.—Side view of adult female sorghum midge, with ovipositor extended. Twenty times natural size.

spikelet, it is not uncommon for several females to follow one another in quick succession, each laying an egg within the spikelet.

The egg hatches in 2 days, and the resulting small, translucent maggot (fig. 4) establishes itself head downward close to the developing grain, and from this it extracts its food. The larva does not move from this position until it is ready to pupate; then it reverses itself so that its head is toward the tip of the spikelet and its back to the seed. When feeding begins the larva turns a pinkish shade, which deepens as the larva grows, until at the time of pupation it is a distinct red. The part of the seed in contact with the larva shrinks, and the larva lies in the resulting shallow, irregular depression. An infestation of 1 larva per spikelet is sufficient to cause complete loss of the grain (fig. 5, *B*), but as many as 8 or 10 larvae may develop to maturity on the same seed.

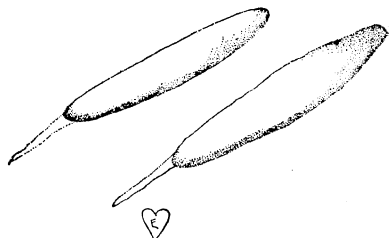


FIGURE 3.—Eggs of sorghum midge. Two hundred times natural size. Note the "stem" by means of which the egg is attached to the blossom.

The larvae become full-grown and pupate in from 7 to 11 days. When newly formed, the pupae (fig. 6) are uniformly red, but the head and appendages soon turn dark brown or black. The adults, or midges, are ready to emerge from the pupal stage at the end of 3 days.

At this time the pupa works its way to the tip of the spikelet, where its skin splits and the adult is liberated.



FIGURE 4.—Larva of the sorghum midge: *A*, Dorsal view of larva, with proboscis extended; *B*, same, with proboscis retracted; *C*, side view. Twelve times natural size.

Under normal summer temperatures from 14 to 16 days are required for the complete life cycle. This time varies with the tempera-

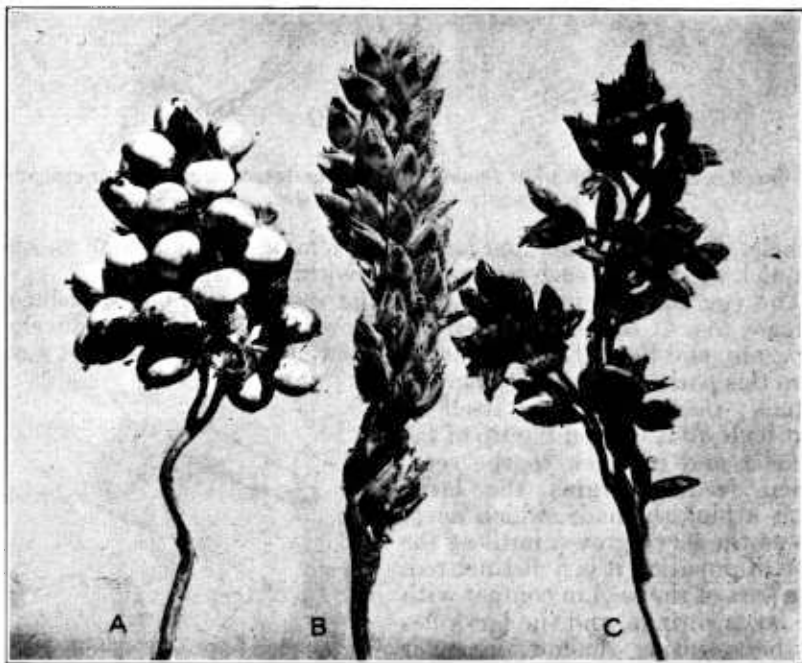


FIGURE 5.—Spikelets of sorghum heads: *A*, Normal; *B*, severely injured by the sorghum midge; *C*, injured by birds. Slightly enlarged.

ture, and is longer in the earlier and later parts of the season and during cool spells in summer.

SEASONAL HISTORY

The adult flies of the sorghum midge first appear early in the spring at about the time that Johnson grass begins to bloom, and in the heads

of this grass they lay their first eggs. The flies continue to emerge from hibernation well into the summer, the greatest emergence occurring at about the time the early crop of sorghum is blooming. Where there are only a few host-plant heads in a suitable condition for egg laying, the females concentrate on these heads, and an extremely heavy infestation in them results. This is true of the earliest blooming host plants in the spring and also of the earliest blooming heads in cultivated sorghums. Throughout the season the female midges are very active in laying their eggs on the flowering heads of any available host plants.

Successive life cycles occur throughout the season from the first emergence of hibernating individuals in the spring until the host plants are killed by freezing temperatures in the fall. These generations overlap to such an extent that no well-defined broods are apparent, and all stages of development may be found in the field at any time. One or two generations usually occur on the volunteer or wild hosts early in the spring before the cultivated crops bloom.

The midges hibernate as larvae within cocoons in the spikelets of their host plants (fig. 7). The cocoon is brown, and it is difficult to distinguish it from the small cocoons of some other insects, for the debris from the spikelet of the host plant adheres to it. As the summer progresses, a few of the larvae develop into the hibernating form, but with no apparent regularity. In the fall, however, a larger number of larvae form cocoons. Most of the hibernating, or overwintering, larvae change to pupae and emerge as adults the following spring, but many of them do not emerge until the second or third spring.



FIGURE 6.—Ventral view of pupa of the sorghum midge. Thirty-four times natural size.

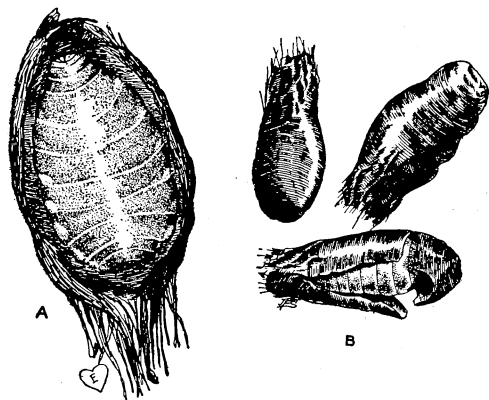


FIGURE 7.—A, larva of the sorghum midge within its cocoon (12 times natural size); B, exterior views of cocoons (7 times natural size).

NATURAL ENEMIES

Birds, spiders, and insects play their part in keeping the sorghum midge in check. In localities where the midge is plentiful large numbers of spiders are found on the sorghum heads, and more than 20 species have been observed feeding on adult midges.

Many species of ants, including the Argentine ant (*Iridomyrmex humilis* Mayr) and the small fire

ants (species of *Solenopsis*), destroy many midges by swarming over the sorghum heads and seizing the pupae which protrude from the spikelets. The newly emerged adults are attacked before they are capable of flight.

Three tiny, wasplike parasites have been found feeding on the larvae and pupae of the sorghum midge. For some unknown reason two of these, which were formerly very abundant, have almost disappeared from the fields. The third species, known only by its scientific name, *Eupelmus popa*, was apparently brought to the United States from India by accident about 1909 and is now found wherever the midge is abundant. Its life cycle is closely correlated with that of the sorghum midge except that it emerges from hibernation a few days later in the spring. These parasites increase in number rather slowly early in the spring. It is not until late in the summer that they are abundant enough to check materially the amount of damage being done by the midge.

IMPORTANT FACTS BEARING ON THE CONTROL OF THE SORGHUM MIDGE

The most important factor affecting the amount of damage that may be done by the sorghum midge is the source of infestation. No serious injury to a field of sorghum can occur unless there is a nearby source from which an influx of female midges may come.



FIGURE 8.—Johnson grass, patches of which in uncultivated places and along the edges of fields are known to harbor large populations of the sorghum midge.

Johnson grass serves as a prolific source for the infestation of nearby fields (fig. 8). When allowed to head, this grass provides an excellent place for hibernation. It blooms very early, thus permitting the individuals first emerging to breed and increase in number materially before the sorghum fields come into bloom. Midges also continue to breed throughout the season in Johnson grass, thereby making it a constant source of infestation to blooming sorghum fields.

Infested fields of early sorghum from which midges are emerging are serious sources of infestation to adjacent fields that come into bloom later.

Volunteer and early-blooming host plants may develop in a field some time before the main crop comes into bloom. These early heads

are usually heavily infested and may become an important source of infestation for the remainder of the field.

Adult midges may fly a considerable distance from an infested source to the blooming host plants, especially with the help of the wind, which is an important factor in the dispersion of the adults over nearby fields. Practically all spread is in the direction of the prevailing winds.

RECOMMENDATIONS FOR CONTROL

Because all stages of the midge, with the exception of the adult, are passed within the seed husks, there are at present no practical means of controlling it by the use of insecticides.

The losses of grain that this insect brings about in sorghum fields are due both to the midges that come from outside sources and also

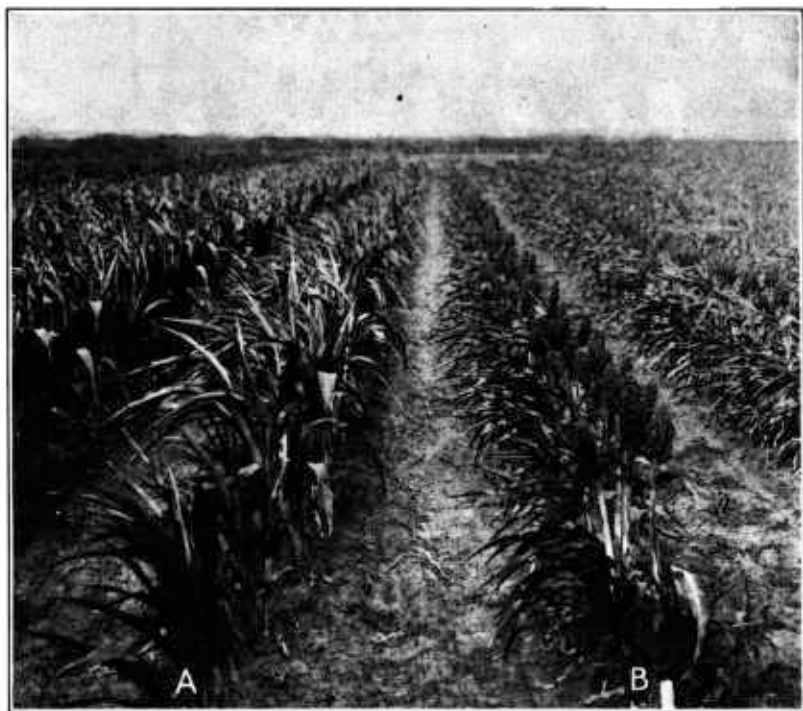


FIGURE 9.—Rows of different varieties of grain sorghum: *A*, Row of plants on which heads have not yet emerged; *B*, a row of plants fully headed out and exposed to attack by the sorghum midge.

to those produced within the field. Considerable loss can be prevented by putting into effect the following recommendations:

Use only pure seed of as uniformly blooming a strain as it is possible to obtain. If two plantings that will bloom at different times are to be made near together (fig. 9), use pure seed for each and arrange the

planting so that the prevailing winds will blow toward, rather than from, the early-blooming field.

Prepare a good seedbed and cultivate the field to produce as uniform a crop as possible.

Space plants so as to produce the smallest number of tillers that will give a satisfactory yield.

Plant at the time of the season best suited for the variety selected. Planting can be done at any time in the season provided a uniformly blooming crop is produced.

Prevent Johnson grass from producing heads in or near the sorghum field previous to the blooming of the crop. If Johnson grass or



FIGURE 10.—Heads of sorghum seed temporarily covered with paper bags for protection from the sorghum midge.

sorghum hay is produced near the field, it should be cut and removed several days before the grain crop comes into bloom. Grass that cannot be cut before the sorghum crop begins to bloom should be left until blooming is completed. Cutting such hay while the sorghum is blooming will cause the adults emerging from the cut grasses to go to the sorghum to lay their eggs.

Heads of sorghum that bloom much before the main crop should be destroyed. If such heads are cut within 5 days after the first blooms appear, they can safely be left on the ground. If cut later, especially in the fall, they should be removed from the field and destroyed before any midges can emerge from them.

Locate the fields as far as possible from all outside sources of infestation, such as earlier sorghum, Johnson grass, or other host plants.

Where sorghum grain is threshed, plow under or destroy, before the spring emergence of the midges, all refuse not eaten by livestock. After harvest rake up and destroy all loose heads in the field.

Cultivate or burn over fields of Johnson grass early in the spring to destroy hibernating midges before they can emerge.

Small crops of seed can be obtained if paper bags are tied over the heads of selected host plants during the blooming season, thus protecting the heads from infestation by the midge (fig. 10). These bags have no effect on the development of the seed. They may be placed on the heads as soon as the latter are out of the boot, but they should be removed shortly after the blooming period, as they produce conditions favorable to the development of the various worms that attack the grain heads.